

Footstep localization by acoustic signals

Dekkers G., Van Den Broeck B., Karsmakers P. and Vanrumste B.

Abstract Containing healthcare costs related to the aging population is a well-known challenge for Western societies. Technological research is directed to enable older persons to stay longer and safer in their own dwelling. A possible solution is an audio based home monitoring system. Previous research indicated a relation between a person's gait and his or her health. This work focuses on localizing footsteps by use of acoustic information. The acoustic information is retrieved from a Wireless Acoustic Sensor Network (WASN) containing multiple linear microphone arrays (nodes). In the proposed WASN setup the nodes were uniformly distributed in a room and placed at ground level which makes it a two-dimensional localization problem. Processing is done in three different stages. At first footstep activity is detected by an energy based approach. Then sound energy coming from a certain direction is estimated for each node with Steered Response Power (SRP) combined with a PHase Transform weighting. In the last stage the directional patterns of each node are combined to construct a two-dimensional localization map by using Least Squares (LS) or Global Coherence Field (GCF). Real life data has been collected in an office setting including two test subjects walking a predefined path of eight steps. Each person repeated the experiment eight times yielding a dataset with 128 footsteps. The proposed system achieved a smallest median of error of 31 cm for the best step of the eight predefined steps.

Dekkers G.^{abc}, Van Den Broeck B.^{abc}, Karsmakers P.^{abc} and Vanrumste B.^{abc}

^aESAT-STADIUS, KU Leuven, Kasteelpark Arenberg 10, 3001, Heverlee, Belgium

^biMinds, Medical IT, Kasteelpark Arenberg 10, 3001, Heverlee, Belgium

^cAdvanced Integrated Sensing lab (AdvISE), KU Leuven, Kleinhoefstraat 4, 2440, Geel, Belgium
e-mail: gert.dekkers@kuleuven.be (Dekkers G.)